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GAS ABSTRACTS

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1. GAS INDUSTRY

Fuel Outlook

Terry, L. F. FUELS OF THE FUTURE. *Am. Gas Assoc. Monthly* 30, 13-16 (1948) *April.*

Changes taking place in the supply channels for mineral fuels indicate further expansion of the natural gas industry during the next decade. For the last 30 years the annual production of coal has not increased, and the expansion in the country's fuel needs has been met by the rapidly increasing production of crude oil and natural gas. Low prices, considering operating efficiencies and other relative factors, have provided considerable advantages to oil and gas in their inter-competition with coal. The increasing cost of finding and producing oil may make its competitive position less favorable in the future. Deeper drilling is expected to lead to the discovery of as much or more gas than oil, since the higher reservoir pressures encountered compress gas in double or treble the amounts per cu ft of reservoir space as those found in shallower strata. During the next decade, annual production of natural gas may be expected to rise from the current 5.6 trillion cu ft to 8-9 trillion, along with an unpredictable, but probably substantial increase in known reserves.

J. C. Lane

Natural Gasoline Plant Construction

Tuttle, R. B. CONSTRUCTION UNDER WAY WILL INCREASE OUTPUT OF NATURAL-GASOLINE, CYCLING PLANTS. *Oil Gas J.* 46, 145-146 (1948) *March* 25.

It is stated that 464 natural gasoline plants and 49 cycling plants are currently producing about 20,000,000 gal per day of liquid products. New construction scheduled is listed together with ratings, companies and contractors.

J. D. Parent

Natural Gasoline Plant Production

Casper, J. C. NATURAL-GASOLINE CYCLING-PLANT PRODUCTION MAY REACH 17 MILLION GALLONS DAILY. *Oil Gas J.* 46, 129-132 (1948) *March* 25.

Monthly production at natural gasoline and cycling plants exceeded the half-billion gallon mark in December, bringing the total for the year up to 5,544,044,000 gallons, 14.1% above that in 1946. Increases in plant capacity during 1948 should result in an average production for the year of at least 16,800,000 gal. per day.

J. C. Lane

Natural Gasoline Plants

SURVEY OF NATURAL-GASOLINE PLANTS. *Oil Gas J.* 46, 135-136, 139, 141-142 (1948) *March* 25.

In its annual survey of natural gasoline plants this journal gives the identity, location, and capacity of 513 natural gasoline and cycling plants in this country.

J. C. Lane

Reserves

OIL AND GAS RESERVES. *Pipe Line News* 20, 7-9 (1948) *March.*

As of December 31, 1947, the United States'

proved reserves of liquid hydrocarbons were 24,771,660,000 barrels and the nation's proved natural gas reserves were 165.93 trillion cu ft, up some 3.0% and 3.3%, respectively, over the proved reserves at the end of 1946. Proved reserves of natural gas liquids, as of December 31, 1947, are estimated as 3,253.9 million bbls, about 2.9% above those at the end of 1946. The statistics are also broken down by states, with 1947 production shown in the case of petroleum and natural gas liquids. Sources of the estimates are the American Petroleum Institute and the American Gas Association.

J. C. Lane

The following article, which has not been abstracted, is called to your attention:

PROVED NATURAL GAS RESERVES RISE. *Am. Gas Assoc. Monthly* **30**, 25-28, 46 (1948) *April.*

2. APPLIANCES

Gas Range Ventilation Hood

Warren, H. L. REPORT OF PERFORMANCE OF A DOMESTIC KITCHEN VENTILATION HOOD. *Gas Age* **101**, 28-31, 52, 54, 56 (1948) *April* 1.

A complete domestic gas range ventilation system has been designed and tested for removal of odors, vapors and sensible heat from the kitchen. A hood extends over the top burners and is inter-connected to the oven and broiler. A motor driven blower draws vapors and combustion products through the hood and forces them outside the building by way of the floor and basement wall. There is no effect on combustion and cooking operations due to the air circulation. Efficiencies of removal of vapors and odors resulting from combustion and cooking are between 93-99% for normal range operation.

E. F. Davis

Heat Pump

Kemler, E. N. and Kulik, N. RESEARCH ASPECTS OF THE HEAT PUMP. *Heating, Piping, Air Conditioning* **20**, 107-112 (1948) *April.*

The progress to be expected during the next few years in application of the heat pump to year round residential air conditioning will depend directly upon the amount and type of research work that will be conducted. The most important heat pump problem today, insofar as residential applications are concerned, continues to be that of the heat sources, the two basic sources being the atmosphere and the earth. The authors outline the type of research that should be conducted and discuss the various considerations affecting the problem. A comprehensive tabulation of the various items to be considered in preparing a program of research on the heat pump is included.

Authors' summary

LP-Gas Space Heater

Schlich, V. A. POTATO SHIPPERS USE LP-GAS. *LP-Gas* **8**, 34, 75 (1948) *April.*

A thermostatically controlled portable space heater using LP-gas is now being employed to preheat railroad refrigerator cars prior to packing and shipping potatoes.

E. F. Davis

3. COMBUSTION AND INDUSTRIAL FURNACES

Coal Ash Slag

Cohen, P. and Corey, R. C. BEHAVIOR OF ASH IN PULVERIZED-COAL-FIRED FURNACES. *Combustion* 19, 33-40 (1948) *January.*

The viscosity characteristics of coal ash slags are dependent not only on the ultimate composition of the slag but also on the state of oxidation of the iron present. Coal ash slags exhibit viscosities which are termed fluid, critical, and plastic depending on the temperature and these viscosities vary with temperature according to the general equation $n^{-0.1614} = 0.000452\,t - B$ where n represents the viscosity in poise, t the temperature in °F and B a parameter. The author summarizes present knowledge as to fundamental flow properties of coal-ash slags including plots of temperature of critical viscosity, freezing temperature and relative thickness of slag deposits as a function of composition and ferric percentage for a silica-alumina ratio of 2. On the basis of data presented, a practical calculation of thickness of slag deposit is illustrated. Since performance data are meager, a broad experimental program relative to ash and slag is recommended.

C. Von Fredersdorff

Determination of Combustion Conditions

USE OF 'CALYX' BURNER TO DETERMINE COMBUSTION CONDITIONS. *Nature (British)* 161, 395 (1948) *March* 13.

Another method is proposed for determining the air theoretically required for combustion of a gas, (in this case coal gas). This method involves the observation of the 'Calyx' (a violet sheath appearing around the lower part of the flame) until it is most prominent, at which point the theoretical air-gas mixture is obtained. Experiments indicate that this occurs after the maximum CO_2 concentration in combustion products has been attained.

E. F. Davis

Fume Ignition Temperatures

Jares, J. DISPOSAL OF OIL AND VARNISH FUMES BY COMBUSTION. *Industrial Gas* 26, 6-8, 20-22 (1948) *April.*

A technique has been developed at the Brooklyn Union Gas Company for determining fume ignition temperatures. The apparatus is used for the disposal of combustible oils and vapors emitted during varnish cooking, by burning in a gas fired combustion chamber. Minimum ignition temperatures and maximum fuming rates have been determined for various oils and resins in the apparatus.

E. F. Davis

Gas Turbines

Rose, H. J. RECENT ENGINEERING DEVELOPMENTS IN SWITZERLAND ON GAS TURBINES AND STEAM GENERATORS. *U.S. Bureau of Mines Inf. Circ. 7403* (1947) *June.*

A report of the Solid Fuels Mission of the Technical Industrial Intelligence Committee, prepared by Dr. Harold J. Rose, Vice President and Director of Research of the Bituminous Coal Research, Inc., is given. The sole purpose of the investigation was to determine what progress had been made in Switzerland during the war years in developing equipment for the more effective utilization of coal. Particular

attention was given to developments that may permit the use of coal for firing gas turbines. Information of additional subjects of interest collected and presented by the committee include: (1) Experimental burning of coal under pressure in Velox boilers. (2) Recent commercial developments in Monotube high pressure boilers fired with coal. (3) Combined heat and power plants. (4) Commercial development of the heat pump for space heating and other uses. (5) Comfort heating by radiation from ceilings. Three Swiss companies which have been prominent in designing and manufacturing equipment of the sort mentioned above, were visited by the committee, and the results of the interviews are given in the report under the individual firm names, namely: (1) Brown, Boveri and Company Ltd., (2) Escher Wyss Engineering Works Ltd., and (3) Sulzer Brothers Ltd.

C. Von Fredersdorff

High-Speed Heating

Hess, H. O. HIGH-SPEED GAS HEATING FOR PRODUCTION FORGING. *Industrial Gas* **26**, 5-9, 28-30 (1948) *March.*

Total advantages of high-speed heating surpass mere competitive values on one kind of energy against another. In this review, the ability of gas to produce direct economies is outlined in the single field of forging and conclusion can rightly be drawn from the forging example that gas has a place in economic production far more vital than has generally been reckoned. The focus of interest, however, should be on benefits the new uses of high speed gas heating can bring to the industrial community. Thus, our review of conditions in the field of forging shows the way products and processes can be improved, with the ultimate and necessary result that prices of finished industrial product can be deeply reduced. Seen in this light, gas gains a new character, not simply fuel but a most powerful means of aiding the economy of the country. To use any other focus is to miss the hopeful view of continuing prosperity and the part high speed gas heating will have in it.

Author's abstract

Premixed Combustion

Funk, E. J., Jr. PREMIXED COMBUSTION FOR EFFICIENT PROCESS HEATING. *Industrial Gas* **26**, 18-20, 22, 24-25 (1948) *March.*

Methods of obtaining premixed gas and air for combustion are discussed. Several applications of this type of combustion are detailed to include the advantage and the protection that must be afforded.

E. F. Davis

Radiant Tubes

Workman, R. USE OF RADIANT TUBES IN THE INFRA-RED PROCESS. *Gas Times* **54**, 413-414, 416 (1948) *March* 26.

It is felt that the radiant tube form of oven offers advantages over other types, particularly in regard to initial cost and maintenance cost, while the method of construction facilitates heating of irregular shaped articles. Radiant heat is by no means applicable to all problems, but it does appear that a combination of radiant heat and forced convection can be very advantageous. In certain instances use can be made of the hot waste gases already under pressure from the eductor as a means of obtaining the necessary air movement within the oven without recourse to additional fans and equipment.

E. F. Davis

4. CARBONIZATION AND GASIFICATION

Activated Carbon

Courouleau, P. H. and Benson, R. E. ACTI-

VATED CARBON (MANUFACTURE, CAPACITY OF ADSORPTION, USE IN SOLVENT RECOVERY). *Chem. Eng.* 55, 112-115 (1948) *March.*

This article is a generalized discussion on activated carbon. The topics covered are: carbonization, activation, capacity of adsorption, and the use in solvent recovery.

E. Strong

Air-Drying of Coal

Cooper, H. M., Tarpley, E. C. and Abernethy, R. F. HEATING-VALUE LOSS OF COAL ON AIR-DRYING. *U.S. Bureau of Mines Report of Inv. 4197* (1948) *February.*

The standard method of employing preliminary air-drying to determine the moisture in coal has been criticized with respect to the loss of heating value from excessive air drying. It was found that the heating value loss depends on the rank and type of coal. While heating value losses were not detected in low volatile bituminous coals, a slight degree of oxidation was noted in high-volatile C bituminous and subbituminous B coals. The heating value loss due to 1 or 2 days' exposure beyond the time when the air-dry weight loss is less than 0.1% per hr. is negligible.

C. Von Fredersdorff

Coke Utilization

THE UTILIZATION OF COKE. *Bull. Brit. Coal Utilization Research Assoc.* (*British*) 12, 1-5 (1948) *January.*

A brief description of marketing and utilization of coke breeze in steam boilers and domestic coke burning appliances and covering domestic coke in U.S.A. is presented.

C. Von Fredersdorff

Continuous Distillation

Boselli, M. POSSIBILITIES OF CONTINUOUS DISTILLATION. *Gas World* (*British*) 128, 417-421 (1948) *March* 13.

Theoretical considerations as to gas yields and gas heating values by introduction of steam to continuous vertical carbonizing retorts indicate advantages as to greater thermal efficiency. Results of experiments at the gas works at Turin using German pit coal have borne out the theoretical principles and have shown average results as follows: gas, cu ft per ton dry pit coal, 84,460—88,300; heating value, gross Btu/cu ft, 324—329; lb dry coke discharged per ton dry pit coal charged, 515—560; lb dry coke in gasogenes per ton dry pit coal, 1948; lb steam injected into chambers per ton dry pit coal, 4368; lb steam injected in gasogenes per ton dry pit coal, 1792.

C. Von Fredersdorff

Foundry Coke

SURVEY OF FOUNDRY COKE CHARACTERISTICS. *Ind. Heating* 15, 424, 426 (1948) *March.*

A paper presented at the 51st annual meeting of the American Foundrymens Association consists of a review of recent literature and test data covering the following classifications: (a) specifications, (b) analytical and test methods, (c) combustion and combustion tests, (d) reactivity and reactivity tests, (e) properties, (f) structure, (g) cupola operation, (h) blast furnace operation, (i) chemical treatment, and (j) production.

C. Von Fredersdorff

Free-Swelling Index of Coal

Selvig, W. A. and Ode, W. H. AN INVESTIGATION OF A LABORATORY TEST FOR

DETERMINATION OF THE FREE-SWELLING INDEX OF COAL. *U.S. Bureau of Mines Report of Inv.* 4238 (1948) *February.*

The "ASTM Standard Method of Test for Free-Swelling Index of Coal" has proved to be of value in obtaining information regarding coking properties of coal in fuel beds. The free-swelling index is not a measure of and is not recommended for the measure of the expansion or contraction occurring during carbonization of coal in coke ovens. A method, including equipment and procedure, is described for determination of free-swelling indices of coals whose coke buttons do not conform to standard profiles. A series of standard profiles is reproduced in fuel size and a curve is included showing areas of profiles as a function of the swelling index.

C. Von Fredersdorff

Gas Cooling

Brown, T. W. GAS COOLING. *Gas World "Supplement"* (*British*) 128, 30-36 (1948) *March* 6.

The author presents heat balances at various points in a coke oven recovery train and discusses the relative quantities of sensible and latent heat present in the gas stream at the collecting main, pitch collector, primary gas coolers, saturator, secondary gas coolers and scrubbers.

C. Von Fredersdorff

Gas-Making Process

DeCoriolis, E. G. NEW GAS-MAKING PROCESS ON THE LINE. *Gas Age* 101, 23-25 (1948) *April* 1.

The features of a plant for making gas by catalytic cracking of hydrocarbons are described. Briefly they are as follows: (1) the area required is small, (2) no storage holders are required, (3) operating labor amounts to two men per shift, (4) the plant can be located at any point on the distribution system, and (5) the gas produced requires no purification. This process is well suited to take care of peak loads.

W. J. Merwin

Gas Purification

Radford, D. E. THE PREPARATION AND USE OF PELLETED FERRIC OXIDE FOR GAS PURIFICATION. *Natl. Gas Bull.* (*Australia*) 11, 14-19 (1947) *November-December.*

Experiments with pelleted oxides on a laboratory scale indicated that (1) either artificial or natural oxides can be formed into balls of any desired diameter and which are mechanically stable to withstand ordinary handling in purification processes, (2) resistance to gas flow is very low, (3) artificial oxide pellets can absorb over 50% of sulfur before becoming saturated whereas natural oxide pellets indicate a maximum 32% sulfur absorption, (4) a given weight of artificial oxide should do the equivalent work of from 1.6 to 2.0 times as much natural oxide. The author proposes the use of these pelleted oxides in a tower purifier as a solution to the labor, back pressure, ground space and hardening problems associated with conventional dry box purification.

C. Von Fredersdorff

Gas Works Mechanization

Woodall, J. D. C. MATERIAL HANDLING ON A PROVINCIAL GAS-WORKS. *Gas J.* (*British*) 253, 573-576, 579 (1948) *March* 17.

Considerable saving in labor cost was realized thru a more complete mechanization of the plant at Maidstone. Particular advantage was gained in the discharge of iron oxide purifiers by tractor crane, and in coal handling by the

installation of larger bins and a new charging machine. Other improvements in the material handling equipment consist of a new hot coke machine, a new LeFleuve conveyor for breeze separation and a breeze grabbing unit for the breeze settling pit.

C. Von Fredersdorff

Heating C. V. Retorts

HEATING C. V. RETORTS BY MECHANICAL PRODUCERS. *Gas World* (*British*) 128, 338-340 (1948) *February* 28.

The use of producer gas from mechanical producers for heating continuous vertical retorts has shown that due to a relatively constant calorific value of 133 ±5 Btu and ease in control of gas pressure and volume: (1) constant temperature resulted in the combustion chambers of the retorts, (2) complete combustion of producer gas was obtained, (3) constant waste gas conditions to the waste heat boilers resulted and (4) flue dust was decreased.

C. Von Fredersdorff

Low Temperature Coal Carbonization

Reid, W. T. LOW TEMPERATURE CARBONIZATION OF COAL IN JAPAN. *U.S. Bureau of Mines Inf. Circ.* 7430 (1948) *February.*

Results of an investigation conducted between April and August, 1946, disclosed that low temperature carbonization of coal in Japan served as an important source of liquid fuels during the last war. A total of 10 plants located in Japan proper, Karafuto and Korea produced some 109 million gallons of liquid products. Semi-coke by-product produced at the rate of 450,000 metric tons per year served as a domestic fuel, as a raw material in portable gas producers, and as a substitute for imported low-volatile bituminous coal. Plant equipment, primarily of German design, consisted for the most part of Lurgi carbonizers and Koppers units, although several Japanese designed carbonizers and American designed Knowles ovens were in operation. Japanese designed plants did not carbonize strongly coking coals satisfactorily, while the Lurgi and Koppers units operated only with very weakly caking or noncaking coal successfully.

C. Von Fredersdorff

Reactivity of Solid Fuels

Orning, A. A., Mallov, S. and Neff, M. REACTIVITY OF SOLID FUELS TO AIR AND OXYGEN. *Ind. Eng. Chem.* 40, 429-432 (1948) *March.*

A modified apparatus and procedure for determining the reactivity indices of solid fuels, based on the measurement of self heating rates at substantially adiabatic conditions is described. The procedure consists in obtaining the rate of temperature increase of the sample in the presence of an oxidizing gas as a function of temperature and determining the temperatures at which the rate of temperature rise is 15 and 75°C per min. It was found that the reaction between coals and oxidizing gases was not of first order, but of some variable order with temperature. Reactivity indices obtained with previous equipment indicated approximate correspondence with the tests on the modified equipment described herein.

C. Von Fredersdorff

Town Gas Manufacture

Dent, F. J. THE USE OF OXYGEN FOR TOWN GAS MANUFACTURE. *Gas World* (*British*) 128, 384-385 (1948) *March* 6.

Several papers presented to the Institution of

Chemical Engineers and the Physical Society pointed out that although oxygen gasification of coal has the advantage of a higher thermal efficiency as compared to the present carbonization and water gas processes, replacement of present processes is not anticipated in the near future since, (1) there is no evidence as to the flexibility of oxygen gasification, and (2) the demand for gas must outstrip that for coke or at least gas must replace coke in many applications.

C. Von Fredersdorff

Treatment of Gasworks Effluent

Nicklin, T. THE TREATMENT OF GASWORKS EFFLUENT. *Gas World* (*British*) 128, 300-303 (1948) *February* 21.

Oxygen absorbing organic impurities present in ammonia liquor obtained from gas retorts, condensers and washers constitute in many cases a difficult disposal problem. Since it is not desirable from a health standpoint to discharge the waste liquor directly into rivers or sewers, pretreatment such as distillation to remove free ammonia and oxygen absorbing sulfides, and plant operation to prevent as much as possible any increase in oxygen absorption of the liquor is recommended. Other possible means of treatment are evaporation in producer cooling jackets, evaporation at the base of a chimney, filtration through bacteria filter beds, activated carbon adsorption of phenols, and extraction of phenols by either a single solvent such as benzole or a two-solvent system such as benzole-butyl acetate.

C. Von Fredersdorff

5. NATURAL GAS AND NATURAL GAS CONDENSATES

Cleaning Transmission Lines

Eisenberg, H. CLEANING OF HIGH PRESSURE GAS MAINS. *Gas Age* 101, 20-21 (1948) *March* 18.

A method for removing gum formations from high pressure transmission lines is discussed. The gum is first softened with steam; then the gum is removed from the pipe by pulling Go-Devils in ascending sizes through the pipe with the aid of a winch. The Go-Devils contain several rubber and steel disks with steel spacers. Two photographs and six drawings are given.

E. Strong

Compressors

Boyer, R. L. MODERN GAS PIPE LINE COMPRESSORS. *Petroleum Engr.* 19, 199-200, 202, 204, 206 (1948) *March.*

An effort is made to point out recent progress on compressor design. Some cost data are given for horizontal and angle types; cost break-downs are given. Fuel costs are quite interesting and are furnished for 2 and 4 cycle engines and the new 2 cycle engines as a function of load. A rough figure is 10 cu ft of natural gas per bhp hr.

J. D. Parent

Corrosion

Hackerman, N. and Shock, D. A. PROTECTIVE LAYER FORMATION IN CONDENSATE WELLS. *Gas* 24, 40-43 (1948) *February.*

Of two wells from the same producing zone in Opelika Field, Texas, one was corrosive, and the other non-corrosive. Study of the well constituents showed that the latter contained a natural inhibitor, naphthenic acid, which formed a protective layer film. Injection of commercial naphthenic acid in the corrosive well produced favorable results, and further corrosive attack was decreased. The same effect was obtained when sodium dichromate was added to a corrosive well.

S. Mori

Corrosion

Shock, D. A. TESTING AND SELECTION OF INHIBITORS FOR CORROSIVE HIGH PRESSURE CONDENSATE WELLS. *Corrosion* 4, 179-185 (1948) *April.*

A universal inhibitor, applicable to all corrosive gas condensate wells, is not known at present, and each well requires a specific inhibitor. In order to select the suitable inhibitor for a given well, the author gives the requirements of a satisfactory inhibitor and describes methods that are used to test their effectiveness in the given well. The gas condensate wells are usually under high pressure and acidic in character, and require an inhibitor that either raises the pH of the fluid, or prevents the water phase from coming into contact with the steel.

S. Mori

Cycling

Sloan, J. P. LABORATORY STUDIES & THEIR RELATION TO CYCLING PROBLEMS. *Oil Gas J.* 46, 158, 161-162, 165-166, 168, 171-172, 175-180, 182, 184, 186, 188 (1948) *March* 25.

In this article the pressure depletion and cycling methods of producing a new condensate reservoir are discussed. In order to estimate recoveries by either of these methods, or a combination of the two, a laboratory study of a reservoir sample is desirable. Precautions, including types of wells to sample, methods of sampling, transport, and storage of samples, are discussed in relation to providing a sample representative of the condensate reservoir. An equilibrium cell used to make typical reservoir analyses is described in detail. This cell is provided with an internal stirrer, a floating piston, and viewing windows, and can be used for studies up to 8000 psi at 300°F. The method followed to duplicate reservoir conditions with this apparatus is explained and a typical procedure is presented whereby changes in gas composition may be followed as the reservoir sample is pressure depleted. Typical data obtained with the equipment are tabulated, and a series of curves presented to indicate the effect of pressure depletion on typical condensate reservoirs.

W. K. Zahray

LPG Bulk Plant

Davies, F. D. CARE IN DESIGN GIVES BULK PLANT OUTSTANDING SAFETY FEATURES. *Butane Propane News* 10, 43-53 (1948) *April.*

Safety in bulk plant operation, based upon correct engineering design and careful employe training, has enabled Petrolane, Ltd., Long Beach, California producers and distributors of liquefied petroleum gas, to construct a bulk plant in which effort has been made to incorporate the approved safety features. The accompanying article, drawings and photographs will give the reader an excellent picture of a bulk plant which offers many important safeguards for others planning similar construction.

Editor's abstract

LPG Recovery

Ambrose, Z. C. MORE PROPANE FOR LESS MONEY. *Oil Gas J.* 146, 127, 200 (1948) *March* 25.

A novel design for a cycling process is given. Gas is dehydrated before absorption in order to avoid hydrate formation and in order to increase LPG recovery. The absorber is at 900 psi and 60°F. The lower temperature permits the use of an oil of molecular weight of only 155. This cuts the oil circulation in half. Double stage stripping is practiced but the second

stage uses no open steam so that a dry lean oil is produced. 80% propane recovery and a 15% decrease in cost over conventional design are expected.

J. D. Parent

LPG Recovery

McCullough, G. W., Hackmuth, K. H. and Miller, A. J. MODERN PROCESS METHODS TO IMPROVE LPG RECOVERY. *Petroleum Processing* 3, 307-310 (1948) *April.*

See *Gas Abstracts* 4, 68 (1948) *April* for abstract.

Midget Gasoline Plant

Tuttle, R. B. NEW MIDGET GASOLINE PLANT . . . FOR SMALLER LEASES . . . AND LOWER VOLUMES. *Oil Gas J.* 46, 77-78, 90 (1948) *April* 8.

In contrast to most plants which process in excess of 10 MMcf/day or produce some 10,000 gal/day of liquid, this new plant handles 150 to 3,000 Mcf per day. The economic limits are 3,000 Mcf/day for a gasoline content of ½ gal per Mcf and 150 Mcf/day for 2 gal per Mcf. The basic plant is not designed for LPG recovery and is fully automatic. The absorber pressure is 30 psig and the still pressure is atmospheric. 90% gasoline recovery is claimed. If desired, LPG recovery can be achieved by adding to the scrubber, absorber, still and fractionator an additional column together with auxiliaries. This column and the primary fractionator only use reboilers. One such more complete plant handles 2 MMcf/day producing 8,000 gal/day of liquids. 91% natural gasoline components and 91% total butanes are said to be extracted yielding 120 RVP LPG and 22 RVP gasoline.

J. D. Parent

Pipe-Line Leaks

AVERAGE COST OF REPAIR OF PIPE-LINE LEAKS $1,000. *Oil Gas J.* 46, 141 (1948) *February* 19.

The cost of repairing pipe-line leaks under current operating conditions was said to be $1,000 per leak. This does not include loss of products, damage done, or costs due to interruption in service. This figure was presented by Mr. D. B. Good of the Texas Pipe Line Company in a paper entitled "Economic Factors Bearing on Application of Cathodic Protection," which was presented before the Tulsa chapter of NACE, February 13. Mr. Good said that much expensive reconditioning is being avoided by the use of cathodic protection.

W. J. Merwin

Storage of Natural Gas

Parent, J. D. THE STORAGE OF NATURAL GAS AS HYDRATE. *Institute of Gas Technology Research Bulletin No.* 1 (1948) *January.*

The American Gas Association's Program of Research, Promotion and National Advertising was launched in the fall of 1944, and the work herein reported was undertaken as one of the Research Activities. The technical and patent literature related to the storage of natural gas in the form of hydrate has been searched, and pertinent data have been collected and evaluated. Errors and deficiencies in the literature have been found, and are discussed in this report. Possible processes for forming, storing and regasifying the hydrates of natural gas are suggested. A study of the available data indicates that the storage of natural gas as hydrate appears to be sound from an engineering point of view, and to be of interest particularly because of the relative safety of this method of storage.

Author's abstract

6. PETROLEUM AND SYNTHETIC LIQUID FUELS

Catalysts for Hydrocarbon Synthesis

Riesz, C. H., Lister, F., Smith, L. G. and Komarewsky, V. I. CATALYSTS FOR HYDROCARBON SYNTHESIS. *Ind. Eng. Chem.* 40, 718-722 (1948) *April.*

All of the catalysts for hydrocarbon synthesis at atmospheric pressure contain three or more ingredients. Since one explanation of the action of synthesis catalysts might attribute the two functions of hydrogenation and polymerization to separate constituents of the catalyst, a number of two-component catalysts were prepared which contained cobalt, nickel or iron for the hydrogenating action and thoria, silica, alumina or zinc oxide for the polymerizing action. Cobalt-thoria, cobalt-silica, and cobalt-alumina combinations were particularly active, maximum liquid formation occurring when the metal content of the catalyst was 75 weight percent. Nickel catalysts caused excessive formation of gaseous hydrocarbons. Iron catalysts, in the absence of elevated pressure, were relatively inactive. Various effects of catalyst composition upon activity, selectivity and nature of the products are evaluated.

C. H. Riesz

Cracking Catalysts

Rescorla, A. R., Ottenweller, J. H. and Freeman, R. S. EVALUATION OF CATALYSTS FOR CATALYTIC CRACKING. *Anal. Chem.* 20, 196-202 (1948) *March.*

A group of physical and chemical tests which are used to characterize cracking catalysts are discussed. The physical tests include the determination of density, per cent volatile matter, particle size distribution, and measurement of surface area by KOH adsorption, aromatic adsorption and nitrogen adsorption. The usual chemical tests are made to determine the composition and to determine the extent of contamination by undesirable substances such as iron and sulfur. However, the most pertinent information is obtained from an activity test, wherein a standard gas oil is passed over the catalyst at standardized conditions. The features of the Jersey, Hondry, UOP, and Kellogg methods of determining catalyst activity are described, and the relationship of the various catalyst properties to the performance of the catalyst in commercial units is discussed.

W. J. Merwin

Fluidization

Murphree, E. V., Gohr, E. J. and Kaulakis, A. F. APPLICATIONS OF THE FLUID SOLIDS TECHNIQUE TO PRODUCING SYNTHETIC LIQUID FUELS. *Petroleum Processing* 3, 355, 357-358 (1948) *April.*

See *Gas Abstracts* 4, 12 (1948) *January* for abstract.

Gasoline from Natural Gas

Thornton, D. P., Jr. GASOLINE FROM NATURAL GAS WILL COST 9.14¢ PER GAL, WPRA MEETING TOLD. *Natl. Petroleum News* 40, 23 (1948) *April* 7.

Synthesis of liquid fuels via the Fischer-Tropsch process will cost 9.14¢ per gal from natural gas and about 11.4-16.4¢ from coal, without credit for chemical by-products in either case, Phillips Petroleum Company executives esti-

mate. Investment for a natural gas synthesis plant will range from $3,000 to $4,000 per daily bbl and steel requirements will be about six tons per daily bbl. A synthesis plant using coal would require twice the investment and double the amount of steel. In order to produce 650,000 bbls per day of synthetic petroleum over a 20 yr period, some 47.5 trillion cu ft of natural gas or 2.92 billion tons of coal would be required. Enough gas synthesis plants for this output would cost $2.6 billion to build and would require 3.96 million tons of steel, while coal synthesis plants to turn out the same volume of synthetic product would cost $5.2 billion and require 5.65-7.80 million tons of steel. Gas synthesis operations will be limited to those locations where sufficient gas reserves are available, 0.5 trillion cu ft being necessary to run one 7,000 bbl per day plant for 20 yrs. In view of our limited natural gas reserves, any long-range synthetic liquid fuels plan must be based upon coal.

J. C. Lane

Lubricating Oils

Dazeley, G. H. THE PREPARATION OF LUBRICATING OILS FROM HYDROCARBON-SYNTHESIS PRODUCTS. PART I. *Petroleum* 11, 14-15, 26 (1948) *January;* PART II. *ibid.* 41-44 (1948) *February.*

Diesel oil produced in the Fischer-Tropsch process has been studied as a source of synthetic lubricating oils. The procedure consisted in cracking the diesel oil by one of three methods and polymerizing the resulting olefins in the presence of aluminum chloride. Thermal cracking at atmospheric pressure gave the most suitable polymerization stocks; this was attributed to the predominance of normal alpha olefins in the product. Lubricating oils prepared from the higher fractions of the cracked product gave lubricating oils of good viscosity-temperature properties and satisfactory stability to oxidation.

C. H. Riesz

Refining Processes

MODERN REFINING PROCESSES 1948. *Oil Gas J.* 46, 117-164 (1948) *April* 1.

Forty-four leading processes used in the petroleum refining industry are presented with flow diagrams, a brief discussion of operating principles, and a listing of the various licensors. The types of processes described include thermal and catalytic cracking, polymerization, alkylation, isomerization, hydroforming, desulfurization, super fractionation, ethylene separation, solvent extraction, hydrogen manufacture, and hydrocarbon synthesis.

W. J. Merwin

Synthetic Alcohol

Aries, R. S. SYNTHETIC ALCOHOL FROM PETROLEUM. *Oil Gas J.* 46, 108-110, 133 (1948) *March* 18.

Methods of producing ethyl alcohol from ethylene are reviewed. Manufacturing costs are less than 10¢ per gal and, under specific economic conditions, the total cost would be less than 15¢ per gal. These costs compare favorably with the costs of producing ethanol from grain and blackstrap molasses.

C. H. Riesz

Synthesis Gas Symposium

The following papers were presented at a symposium on the production of synthesis gas before the Division of Gas and Fuel Chemistry at the 112th Meeting of the American Chemical Society, New York, September 15-19, 1947.

Powell, A. R. SYMPOSIUM ON PRODUC-

TION OF SYNTHESIS GAS. *Ind. Eng. Chem.* 40, 558-559 (1948) *April.*

With increasing demands for liquid fuels, the production of synthetic liquid fuels promises to be one of the major technical developments in coming years. The generation of low-cost synthesis gas is probably the most difficult and most important phase of the problem and it is expected that partial or complete solutions may come as a result of (1) use of natural gas as a raw material, (2) use of cheaper grades of coal, (3) economies through large-scale operation, and (4) technical advances due to research and development.

C. H. Riesz

Newman, L. L. OXYGEN IN THE PRODUCTION OF HYDROGEN OR SYNTHESIS GAS. *Ind. Eng. Chem.* 40, 559-582 (1948) *April.*

Processes for the large-scale production of hydrogen and synthesis gas are basically identical. The ratio of hydrogen to carbon monoxide in the synthesis gas may vary from 1 to 2. A plant producing 25,000 barrels of primary liquid fuel per day requires from 700,000,000 to 800,000,000 cubic feet of synthesis gas per day. Low-cost synthesis gas requires the use of lower priced generator fuels, which can best be gasified in continuous internally heated processes using oxygen. Part, if not all, of the energy requirements for oxygen production may be obtained from the heat evolved in the synthesis reactors. The principal processes include: Winkler, gasifying fines in a fixed fluidized bed; Koppers, gasifying pulverized coal in suspension; Lurgi, gasifying fines in a fixed bed under pressure; Thyssen-Galocsy and Leuna, gasifying lump fuel and disposing of the ash as a molten slag. Other processes are briefly discussed in relation to the foregoing. It is concluded that American requirements may best be satisfied by gasification processes using pulverized fuel in suspension. These will permit the use of higher rank caking or noncaking coals, as well as the lower rank subbituminous coals or lignite.

Author's abstract

Seelig, H. S. and Marschner, R. F. PRODUCTION OF SYNTHESIS GAS BY CATALYTIC DECOMPOSITION OF METHANOL. *Ind. Eng. Chem.* 40, 583-586 (1948) *April.*

For experimental use, the production of synthesis gas with a hydrogen to carbon monoxide ratio of two was achieved by the decomposition of methanol over a supported copper-nickel catalyst. Operating temperature was 500-608°F and production of gas amounted to 233-321 cu ft of gas per hr per cu ft of catalyst. The product gas contained 97% or more of hydrogen plus carbon monoxide. Operation for 558 hrs did not impair the activity of the catalyst. A description of the equipment and its operation is presented.

C. H. Riesz

Foster, J. F. PRODUCTION OF WATER GAS FROM PULVERIZED COAL. *Ind. Eng. Chem.* 40, 586-592 (1948) *April.*

Experimental results are presented on an investigation of a continuous process for water gas production in an externally heated retort through which coal and steam are passed concurrently downward. The rate of gasification is shown to depend on the rate of introduction of coal and steam, temperature, chemical activity of the coal and the tube dimensions and is correlated by means of an empirical equation of the form:

$(kLdc)/(b^2T^2) = 4\ 1n\ (1/1\text{-}r) - (r^2/2) - 3r.$

where k = gasification constant; L = heated length of reaction tube, ft; d = diam. of reaction tube, ft; c = rate of carbon supply, lb/hr; b = rate of steam supply including moisture in fuel, lb/hr; T = absolute temp. of gaseous media inside reaction tube, deg R; r = 0.0238 V/b and V = volume air-free gas at 60°F, 30 in. Hg dry, leaving apparatus, cu ft/hr. Although based on experiments with only a 5 and an 8.25 in. diameter tube, application of the above equation to equipment of commercial size is believed justifiable. Results obtained with several grades of bituminous and lignites are reported and an investment cost comparison of the continuous and conventional processes is included.

C. Von Fredersdorff

Wright, C. C., Barclay, K. M. and Mitchell, R. F. PRODUCTION OF HYDROGEN AND SYNTHESIS GAS. *Ind. Eng. Chem.* 40, 592-600 (1948) *April.*

Test data on the production of synthesis gas and subsequent conversion to hydrogen using rice and barley sizes of anthracite and lump sized coke in a commercial producer modified for a continuous oxygen-steam blast indicate that (1) a raw gas very low in nitrogen, containing H_2 and CO in amounts comparable to normal blue gas operation and in a ratio of less than 1.0 can be obtained with coke, and (2) a raw gas of negligible tar content and containing H_2 and CO in a ratio of approximately 1.0 can be obtained with anthracite. Results seem to indicate that the over-all carbon, oxygen and steam consumption for synthesis gas production compare favorably with fixed bed, fluid bed or suspension processes thus far developed for commercial application. Gasification rates based on generator cross-sectional area are some 50 to 150% higher than those normally obtained in the air blown producer but are appreciably lower than those in the pulverized fuel processes such as Koppers. It is felt that a slight reduction in the CO_2 content would make the raw gas from oxygen gasification of anthracite useable for the iso-synthesis process. Raw gas from the oxygen gasification of coke is of such composition that it may be used in the iso-synthesis process directly. A shift reaction and subsequent scrubbing is required for conversion to a gas of a 2 to 1 ratio of H_2 and CO. Losses of CO in pressure scrubbing of CO_2 can be reduced by two stage scrubbing and recycling part of the scrubber gas. Data on catalytic conversion of CO form the basis for heat and material balances calculated for the production of synthesis gas having a 2 to 1 ratio of H_2 and CO, and for commercial H_2 for ammonia synthesis. Relative efficiencies are discussed.

C. Von Fredersdorff

Montgomery, C. W., Weinberger, C. B. and Hoffman, D. S. THERMODYNAMICS AND STOICHIOMETRY OF SYNTHESIS GAS PRODUCTION. *Ind. Eng. Chem.* 40, 601-607 (1948) *April.*

The paper is a discussion of the thermodynamics of the carbon-hydrogen-oxygen equilibrium, considered from the standpoint of synthesis gas production by the oxidation of methane. The influence of pressure, temperature and the oxygen-methane ratio are examined, it being assumed that carbon, hydrogen, water, carbon monoxide, carbon dioxide and methane are the only products at equilibrium. Conditions leading to carbon formation are discussed in detail and data are presented graphically showing the boundary conditions for free carbon formation. A series of twelve figures show the equilibrium synthesis gas yields at various oxygen-methane ratios for pressures to 50 atmospheres and temperatures between 1000 and 1500°K.

S. Katz

Sands, A. E., Wainwright, H. W. and Schmidt, L. D. PURIFICATION OF SYNTHESIS GAS PRODUCED FROM PULVERIZED COAL. *Ind. Eng. Chem.* 40, 607-619 (1948) *April.*

The production of synthesis gas from coal rather than coke presents new and greater difficulties in the purification of the gas to render it suitable for synthesis purposes. With special reference to gas made directly from pulverized coal, an outline is given of purification specifications for Fischer-Tropsch synthesis gas, some of the established purification processes to meet these specifications and analytical methods for detecting and treating low concentrations of impurities tolerable in the purified gas. The main impurity constituents considered are tar, dust, iron carbonyl, sulfur, hydrogen cyanide, ammonia, naphthalene and gum formers.

C. Von Fredersdorff

Reitmeier, R. E., Atwood, K., Bennett, H. A., Jr. and Baugh, H. M. PRODUCTION OF SYNTHESIS GAS BY REACTING LIGHT

HYDROCARBONS WITH STEAM AND CARBON DIOXIDE. *Ind. Eng. Chem.* 40, 620-626 (1948) *April.*

This paper describes the formulation of curves and equations which make possible the selection of reacting mixtures of light hydrocarbons, steam, and/or carbon dioxide to produce synthesis gas having a wide range of compositions without the deposition of carbon on the catalyst. Additional curves make possible the selection of reacting compositions to produce synthesis gas of any desired composition. Laboratory experimental data illustrate the application of the curves and show that the deposition of carbon can be prevented by selecting favorable compositions of reactants. Synthesis gas compositions having hydrogen-carbon monoxide ratios ranging from 3 to 0.5 were produced and are shown to correspond to those predicted from the curves. Results demonstrate the importance of selecting equipment and operating conditions that are of assistance in preventing the deposition of carbon in the catalyst. Pilot plant investigations show that synthesis gas having a wide range of compositions can be produced without interruption of the process and that desired synthesis gas compositions can be made by selecting the composition of the reactants from the curves.

Authors' abstract

Parry, V. F., Wagner, E. O., Koth, A. W. and Goodman, J. B. GASIFICATION OF SUBBITUMINOUS COAL AND LIGNITE IN EXTERNALLY HEATED RETORTS. *Ind. Eng. Chem.* 40, 627-641 (1948) *April.*

Experimental work conducted during the war by the U. S. Bureau of Mines on two pilot plants for the gasification of low grade bituminous coal by external heating indicated that (1) CO and H_2 can be produced at rates of 60 to 70 cu ft per hr per sq ft of heated surface at 1900°F, (2) 1000 to 2300 cu ft of CO and H_2 per hr per sq ft of cross section area are obtainable as compared to corresponding values of 1000 to 8600 for internally heated retorts, (3) various grades of water gas having H_2 to CO ratios varying from 1.9 to 10 are obtainable but lowest cost gases and highest efficiency and capacity are attained at ratios of 2.0 to 2.5. Experimental data and theories of heat transfer and gasification are discussed. An estimate based on the assumption that alloy plate 0.25 in. thick will last 10,000 hrs at 1900°F indicates that the cost of alloy in externally heated retorts would be about 1% per Mcf H_2 and CO mixture. The performance of the annular externally heated retort at Grand Forks and several foreign processes requiring an external heat supply such as the Didier-Bubiag and Freiberger are discussed.

C. Von Fredersdorff

7. ANALYTICAL METHODS AND TESTS

Adiabatic Calorimeter

Stow, F. S., Jr. and Elliott, J. H. ADIABATIC CALORIMETER. *Anal. Chem.* 20, 250-253 (1948) *March.*

The construction and calibration of an adiabatic calorimeter for the measurement of the specific heat of solids and liquids over the temperature range 25° to 300°C is described. The calorimeter bomb and shield are constructed of sterling silver and are suspended in a brass can surrounded by a constant temperature oil bath. Adiabatic control within 0.1°C is maintained during operation. The specific heats of a number of rosin esters were determined with an estimated accuracy of 1%.

H. Hakewill

Hydrogen in Coal

Duffy, T. H. HYDROGEN IN BITUMINOUS COAL. *Southern Power & Industry* 66, 48 (1948) *April.*

The author briefly describes a graphic method for the determination of hydrogen in coal. This method is based on an empirical formula relating proximate analysis, sulfur content, ultimate carbon, and heating value. A nomograph for employing these data to determine hydrogen in bituminous coal is presented.

H. Hakewill

Infrared Analysis

Thornton, V. and Herald, A. E. INFRARED ANALYTICAL TECHNIQUES FOR ANALYZING C_5 MIXTURES. *Anal. Chem.* 20, 9-10 (1948) *January.*

A procedure for the infrared analysis of a mixture of the two C_5 paraffins and six C_5 olefins is described. It was found possible to establish procedures of sufficient precision and speed to be acceptable for plant operation control.

S. Katz

Microdetermination of Carbon and Hydrogen

Furter, M. F. and Steyermark, A. PRESSURE REGULATOR FOR USE IN MICRODETERMINATION OF CARBON AND HYDROGEN. *Anal. Chem.* 20, 257-258 (1948) *March.*

Specifications are given for a new type of pressure regulator for use in the microdetermination of carbon and hydrogen. The advantages claimed for this device are: (1) the elimination of materials subject to the corrosive action of acid and alkali solutions, and (2) the incorporation of an attached scale to indicate pressure settings.

H. Hakewill

Microeffusiometry

Nash, L. K. MICROEFFUSIOMETRY. *Anal. Chem.* 20, 258-262 (1948) *March.*

A procedure for determining the molecular weight of 0.5 cc of permanent gas or 0.5 mg of volatile liquid is fully given. This method is based on the measurement of relative rates of effusion and the use of Graham's law. A diagram of the microeffusiometer is given. The accuracy appears to be better than 2% when applied to single-component permanent gases or condensable vapors. About 15 minutes are required for a single determination.

M. C. Miyaji

Organic Sulfur

51ST REPORT OF THE JOINT RESEARCH COMMITTEE OF THE RESEARCH BOARD AND THE UNIVERSITY OF LEEDS. *Gas Research Board Communication GRB* 33 (1947) *October* 15.

This is a final report covering a 3½ year survey of the distribution of organic sulfur compounds in town gas that was conducted at 14 gas works in the British gas industry. These tests were initiated in an effort to obtain statistical data on organic sulfur in town gas and to define the effects of production conditions upon organic sulfur formation in order to provide the neces-

sary background information required in meeting purification problems. Results for several types of carbonizing plants, as well as other gas-making units, and for coals from seven different fields were included in the survey. Gases having calorific values ranging from those of producer gas and blue water gas to straight coal gas and rich carburetted water gas were tested, and the effect of benzol extraction on organic sulfur content was evaluated. The variation in total organic sulfur content and the distribution of the various types of organic sulfur compounds present is discussed with special regard for the practical significance attached to these factors in considering removal methods. It was generally concluded that the organic sulfur content of the coal used most strongly influenced the total organic sulfur content of the gas produced; but in the case of carburetted water gas the sulfur content appeared to be independent of the coal. It was found that the proportions of organic sulfur compounds in gas were affected by the nature of the carbonizing plant—high temperatures favoring thiophene formation while steaming favored carbon oxysulfide formation. Oil scrubbing for benzol recovery removed most of the thiophene present and a part of the carbon disulfide, but did not affect the carbon oxysulfide. On the average, town gas was found to contain 20-25 gr. S per 100 cu ft and it was thought that this figure could be materially reduced by the application of oil scrubbing for benzol recovery. In all, a total of 250 sets of sulfur determinations were made on 40 different gas streams in the process of the survey. Details of the analytical methods employed and the conduct of the tests at each of the gas works visited are described.

H. Hakewill

Volume and Bulk Density Determination

Gross, W. E. and Gashorn, J. C. AN INSTRUMENT FOR DETERMINING THE VOLUME AND BULK DENSITY OF GRANULAR MATERIALS. *ASTM Bulletin* 151, 55-59 (1948) *March.*

Two instruments are described for making a quick and simple measurement of the volume, the bulk density and the per cent of voids of packed granular materials. While they are particularly designed for use with gas mask canister adsorbents, it is believed that they would be of value for making quick determinations on many other similar granular materials. Drawings with descriptions are given together with a comparison of the reliability with standard tests.

R. Cook

Water in Gases

Weaver, E. R. and Riley, R. MEASUREMENT OF WATER IN GASES BY ELECTRICAL CONDUCTION IN A FILM OF HYGROSCOPIC MATERIAL. *Anal. Chem.* 20, 216-229 (1948) *March.*

The electrical conductivity of a thin film of such a material as phosphoric acid changes over a wide range with changes in the concentration of water in the atmosphere with which it is in contact. By adjusting the pressures of a sample of gas of known and one of unknown composition, they can be made to have the same concentration of water, shown by equal resistances of the detecting film. Apparatus and procedures for determining water vapor under a variety of circumstances are described, and characteristics of the method and sources of error are discussed. The method has the general merits of simplicity of operation, speed, great sensitivity, and wide range. Only small samples are needed, and few substances interfere. The following applications are described: determining water vapor in compressed oxygen, liquid carbon dioxide, and Freon; measuring relative humidity in comparatively inaccessible or small spaces, especially under rapidly changing conditions; determining moisture in pow-

dered solids and the capacity of drying agents; determining the water content of organic liquids and solutions by rapidly measuring its vapor pressure; measuring the permeability of membranes to water; and detecting minute concentrations of combustible gas in air or of oxygen in combustible gas.

Authors' abstract

8. GENERAL AND PHYSICAL CHEMISTRY

Binary Azeotropes

Meissner, H. P. and Greenfeld, S. H. COMPOSITION AND BOILING POINTS OF BINARY AZEOTROPES. *Ind. Eng. Chem.* **40**, 438-442 (1948) *March.*

This paper presents procedures for estimating the composition and atmospheric boiling temperatures of binary azeotropes where one component is a hydrocarbon or a halogenated hydrocarbon and the other an aldehyde, alcohol, monobasic carboxylic acid cresol, ester, ketone or phenol. It is claimed that the azeotropic boiling temperatures may be predicted to within 2% and the composition to within 8%.

S. Katz

Correlation of Azeotropic Data

Skolnik, H. CORRELATION OF AZEOTROPIC DATA. *Ind. Eng. Chem.* **40**, 442-450 (1948) *March.*

A new and very effective method of defining systems of azeotropes is presented. For a system involving an azeotropic agent with the members of a homologous series several relations are proposed: (a) the azeotropic boiling point as a function of the log of the concentration of the azeotropic agent in the solution, (b) the azeotropic boiling point as a function of the boiling point of the pure homolog, (c) the boiling point of the pure homolog as a function of the log of the concentration of the azeotropic agent. The following systems are correlated: benzene-saturated hydrocarbons, benzene-alcohols and ethanol-saturated and unsaturated hydrocarbons. A comparison with previous methods, especially the Mair-Glasgow-Rossini method indicated the greater accuracy of the present method. The concept of "relative azeotropic effect" using the benzene-normal alkane system for reference, is introduced.

S. Katz

Gas Temperature Measurement

Bolles, W. L. MEASUREMENT OF GAS TEMPERATURES BY MEANS OF THERMOCOUPLES. *Petroleum Refiner* **27**, 120-126 (1948) *February.*

The fundamental concepts of heat transfer pertaining to the measurement of gas temperatures by the means of thermocouples are presented. These fundamentals are then developed to show that large and serious errors are likely to occur in the measurement of gas temperatures unless special precautions are observed. The factors which lead to large errors are presented, and finally, the principal precautions and methods of measuring gas temperatures by means of thermocouples are discussed.

W. M. Dow

Heat Capacities of Gases

Crawford, B. L., Jr. and Parr, R. G. SIMPLE EXPRESSIONS FOR THE HEAT CAPACITIES OF GASES. *J. Chem. Phys.* 16, 233-236 (1948) *March.*

A table of constants is presented, which may be used to approximate the heat capacity of a gas as a function of temperature when the vibrational frequencies of the gas are known.

S. Katz

Hydrocarbon Data

Haggenmacher, J. E. HEAT AND THE EXTERNAL WORK OF VAPORIZATION OF TWENTY-TWO HYDROCARBONS. *Ind. Eng. Chem.* 40, 436-437 (1948) *March.*

Vapor pressure data are used to calculate the heat of vaporization (ΔH) and the external work of vaporization (ΔA) for twenty-two hydrocarbons over various temperature ranges. Comparisons of calculated values with precise measurements usually agree to within a few tenths of one per cent.

S. Katz

Ignition of Explosive Gas Mixtures

Muller-Hillebrand, D. THE IGNITION OF EXPLOSIVE GAS MIXTURES BY LOW-VOLTAGE SPARKS. *Engrs. Digest* 5, 70-71 (1948) *February* from *Teknisk Tidskrift* 77, No. 41, 761-765 (1947).

A theory of low voltage spark ignition of explosive gases is proposed. The need for "activated" molecules in the gas is indicated and, in spite of the high local temperatures developed at the electrodes during the spark, it is concluded that the short-term gas discharge following the spark is responsible for the ignition.

S. Katz

Phase Relations of Gas-Condensate Fluid

Eilerts, C. K., Barr, V. L., Mullens, N. B. and Hanna, B. PHASE RELATIONS OF A GAS-CONDENSATE FLUID AT LOW TEMPERATURE, INCLUDING THE CRITICAL STATE. *Petroleum Engr.* 19, 154, 156, 158, 160, 162, 164, 166, 168, 170, 172, 174, 176, 178, 180 (1948) *February.*

Using a windowed equilibrium cell developed by the Bureau of Mines, the authors have determined the specific volumes and liquid gas ratios of a natural gas and four mixtures of condensate at temperatures over the range of —65° to 100°F. Critical pressures and temperatures were determined for each of the five mixtures. Data for temperatures ranging from the critical (—63.2°F) to the cricondentherm (276°F) are presented for a mixture having a composition identical with that of the hydrocarbon fluid flowing from a gas condensate well. The two phase region of this mixture was investigated experimentally above pressures of 750 psi. Pressures up to 5000 psi were employed to obtain compressibility factors in the single phase region, and to determine the phase boundary of the mixture. Experimental values of the critical pressures of the mixtures investigated averaged more than 100% higher than pressures computed by additive methods, while measured values of critical temperatures differed from computed values by extremes of 7% on an absolute temperature basis.

W. K. Zahray

Ignition Temperatures

Scott, G. S., Jones, G. W. and Scott, F. E. DE-

TERMINATION OF IGNITION TEMPERATURES OF COMBUSTIBLE LIQUIDS AND GASES. *Anal. Chem.* **20**, 238-241 (1948) *March.*

A modification of the drop method apparatus for the determination of ignition temperatures is described; in this modification a heated steel block replaces the usual thermostatic bath. Ignition temperatures obtained with the steel apparatus are somewhat lower than those obtained using a nitrate bath. A table of ignition temperatures of about 175 liquids and gases is given.

S. Katz

Thermodynamic Functions of Molecular Oxygen

Woolley, H. W. THERMODYNAMIC FUNCTIONS FOR MOLECULAR OXYGEN IN THE IDEAL GAS STATE. *J. Research Natl. Bur. Standards* **40**, 163-168 (1948) *February.*

The thermodynamic functions for molecular oxygen in the ideal gas state have been recalculated, employing the most recent physical and spectroscopic values. Values for the natural isotopic mixture of molecular oxygen (O_2^{16}, $O^{16}-O^{17}$, $O^{16}-O^{18}$) are given for the heat capacity and the thermodynamic functions $H^\circ - E_0^\circ$, $(F^\circ - E_0^\circ)/T$, and the entropy at 20° intervals to 700 K and 100° intervals to 5000 K. The paper describes the method of computation in detail, and lists the contribution of the several electronic states to the partition function and its derivatives to facilitate later revisions if new spectroscopic data should make it desirable.

S. Katz

9. ORGANIC CHEMISTRY

Aldehyde Synthesis

Adkins, H. and Krsek, G. PREPARATION OF ALDEHYDES FROM ALKENES BY THE ADDITION OF CARBON MONOXIDE AND HYDROGEN WITH COBALT CARBONYLS AS INTERMEDIATES. *J. Am. Chem. Soc.* **70**, 383-386 (1948) *January.*

Preparation of aldehydes from compounds containing an ethylene linkage by the addition of carbon monoxide and hydrogen in the presence of cobalt catalyst has been studied (U. S. Patent 2,327,066 to Otto Roelen). The first step appears to be the formation of an ether-soluble cobalt compound, dicobalt octacarbonyl. While cobalt on a support can be used as catalyst, it was found that lower reaction temperatures are possible if preformed dicobalt octacarbonyl is employed. Standard high pressure steel hydrogenation apparatus was used to conduct the reactions at 100 to 300 atmospheres pressure and at 257°F temperature or lower in the presence of dicobalt octacarbonyl. The poisonous nature of the cobalt carbonyls is emphasized.

C. H. Riesz

Decomposition of Hydrocarbon Mixtures

Kemball, C. and Taylor, H. S. THE CATALYTIC DECOMPOSITION OF ETHANE AND ETHANE-HYDROGEN MIXTURES. *J. Am. Chem. Soc.* **70**, 345-351 (1948) *January.*

The decomposition of pure ethane, ethane-hydrogen mixtures, and ethylene-hydrogen mix-

tures over a supported nickel catalyst at subatmospheric pressures was studied. The course of the reactions was followed by mass spectrometer analyses. The following observations were made: (1) Ethane decomposes to methane and carbon at a rate proportional to the 0.7 power of the ethane partial pressure. (2) The carbon deposited can be converted to methane by hydrogen. (3) The mechanism for the decomposition is said to involve the presence of adsorbed ethylene on the surface of the catalyst. (4) The rate of decomposition of ethane-hydrogen mixtures is proportional to

$$pC_2H_6^{0.7} \times pH_2^{-1.2}$$

when the ratio of H_2:CH_4 is greater than 1:1. (5) At low ratios of H_2:CH_4 (less than 1:1) the rate is abnormally rapid and is proportional to pH_2^{-2}.

W. J. Merwin

Dehydrogenation of Ethylbenzene

Wenner, R. R. and Dybdal, E. C. CATALYTIC DEHYDROGENATION OF ETHYLBENZENE. *Chem. Eng. Progress* 44, 275-286 (1948) *April.*

Laboratory and pilot plant data for the dehydrogenation of ethylbenzene to styrene are presented and are correlated for use in process design calculations. Application of the results to calculate converter dimensions are illustrated by three specific examples.

C. H. Riesz

Hydrogenation Catalyst

Komarewsky, V. I., Bos, L. B. and Coley, J. R. VANADIUM OXIDE, A HYDROGENATION CATALYST. *J. Am. Chem. Soc.* 70, 428-430 (1948) *January.*

The use of vanadium oxide as hydrogenation catalyst for unsaturated hydrocarbons is reported for the first time. Olefins, diolefins and acetylene were readily hydrogenated at 400°C and atmospheric pressure in the presence of vanadium oxide-aluminum oxide (35%-65%). Benzene could not be hydrogenated at atmospheric pressure, but a 27% conversion occurred at 115 atm pressure and 475°C. The catalyst appears to be resistant to sulfur poisoning.

C. H. Riesz

Nickel Catalysts

Adkins, H. and Krsek, G. COMPARISON OF NICKEL CATALYSTS IN THE HYDROGENATION OF B-NAPHTHOL. *J. Am. Chem. Soc.* 70, 412-415 (1948) *January.*

The partial hydrogenation of beta-naphthol was used to compare the catalytic effects of various nickel catalysts. Addition of small amounts of sodium hydroxide was shown to change the course of the hydrogenation, a phenol (5, 6, 7, 8—tetrahydro-2-naphthol) being produced as the main reaction instead of the usual alcohol (1, 2, 3, 4-tetrahydro-2-naphthol).

C. H. Riesz

Nickel Dehydrogenation Catalyst

Adkins, H., Rae, D. S., Davis, J. W., Hager, G. F. and Hoyle, K. SULFUR AS A PROMOTER FOR A NICKEL CATALYST IN DEHYDROGENATION. *J. Am. Chem. Soc.* 70, 381-382 (1948) *January.*

Dicyclohexyl was dehydrogenated to diphenyl in the presence of nickel chromite, benzene being used as an accepter for hydrogen. It was found that thiophene-free benzene was not effective, but benzene containing thiophene or diphenyl sulfide in a suitable ratio of sulfur to

catalyst (about 1 part per 30 parts of reduced nickel) brought about an almost quantitative conversion of dicyclohexyl to diphenyl at 350°C.

C. H. Riesz

Pyrolysis of Methane

Gordon, A. S. PYROLYSIS OF METHANE FLOWING THROUGH A PORCELAIN TUBE IN THE REGION 1000°. *J. Am. Chem. Soc.* **70**, 395-401 (1948) *January.*

Pyrolysis of methane in a porcelain tube has been studied at temperatures of 1844 to 1967°F. Acetylene was observed to catalyze the decomposition since the percentage of acetylene increased with increasing percentage of decomposition. Ethylene did not appear to affect decomposition. The catalytic effect of surface noted in the early stages of the reaction disappeared when methane decomposition reached 30%. In the ranges of decomposition studied (mostly under 10%), the first-order reaction constants increased with increasing decomposition.

C. H. Riesz

10. CHEMICAL ENGINEERING

Complex Mixtures

Harbert, W. D. VAPORIZATION OF PETROLEUM FRACTIONS. *Petroleum Refiner* **26**, 132-139 (1947) *December.*

See *Gas Abstracts* **3**, 193 (1947) *November* for abstract.

Distillation

Larian, M. G. CLARIFICATION NEEDED FOR DISTILLATION TERMS. *Chem. Eng.* **55**, 116-118 (1948) *March.*

The author advocates distinguishing between the theoretical contact unit, which gives one perfect contact, and the theoretical plate, which may perform more than one perfect contact. Similarly, he proposes differentiation between contact efficiency and plate efficiency.

H. Dirksen

Fluidization

Wilhelm, R. H. and Kwauk, M. FLUIDIZATION OF SOLID PARTICLES. *Chem. Eng. Progress* **44**, 201-218 (1948) *March.*

Correlations are presented relating fluidization characteristics to the fundamental properties of the solid and the fluid used. The solids studied varied in size from 5 mm to 0.3 mm in diameter, and in density from 1.125 to 10.792 g/cc. The fluids used were water and air. It is possible to estimate the velocity of initial fluidization and the pressure drops from the correlation presented for solids and fluids falling within the range investigated. Two types of fluidization, which were termed particulate and aggregative fluidization, were observed and discussed.

W. J. Halvorsen

Fractional Distillation

Raw, R. CONTROL OF FRACTIONAL DISTILLATION BY MEANS OF REFRACTIVE INDEX MEASUREMENTS. *J. Soc. Chem. Ind. (British)* **66**, 451-453 (1947) *December.*

In the industrial fractionation of very similar constituents of a mixture, refractive index

measurement may often prove to be the simplest method of characterizing the components. Some experiments with fractional distillation of the alkylanilines are described. The use of refractive indices is recommended on the basis of rapidity and simplicity.

S. Katz

Fractionating Columns

Berg, C. and James, I. J. RATE OF APPROACH TO EQUILIBRIUM OF FRACTIONATING COLUMNS. *Chem. Eng. Progress* 44, 307-314 (1948) *April.*

In order to permit a general evaluation of the specific problem of rate of approach to equilibrium, three theoretical equations have been developed which allow prediction of the time involved in reaching a given reflux composition. The validity of the equilibrium equations was verified using two binary systems with widely variant values of relative volatility and the theoretical variation of reflux compositions with time shown to agree with the experimental results. The method followed in the experimental run procedure is described, and experimental results are plotted alongside theoretical data. In certain cases, the consideration of the rate of approach to equilibrium is an important factor in the rational design of fractionating equipment and the selection of equipment commensurate with material throughout.

W. K. Zahray

Heat Transfer Film Coefficient

Raber, B. F. and Hutchinson, F. W. GRAPHICAL DETERMINATION OF HEAT TRANSFER FILM COEFFICIENT FOR AIR. *Heating & Ventilating* 45, 109-111 (1948) *April.*

Some overall heat transfer coefficients for air are presented graphically.

J. D. Parent

Hydrocarbon Absorption

Edmister, W. C. HYDROCARBON ABSORPTION AND FRACTIONATION PROCESS DESIGN METHODS. *Petroleum Engr.* 18, 130, 132, 134, 136, 139, 142, 144 (1947) *September.*

The author presents a review of the basic absorption equations. The elements of the contributions of Kremser, Souders and Brown, Horton and Franklin and Edmister are reviewed.

J. D. Parent

Abstractor's Note: This article is highly recommended to those wishing to review and be brought up to date on absorption theory.

Edmister, W. C. HYDROCARBON ABSORPTION AND FRACTIONATION PROCESS DESIGN METHODS. *Petroleum Engr.* 19, 200, 202, 204, 206, 208 (1947) *October.*

The theory underlying the development of the Lewis-Sherwood method of making absorption calculations is presented.

J. D. Parent

Abstractor's Note: This installment is well worth reading as the procedure for stripping as well as absorption is given. Sherwood's text, "Absorption and Extraction", presents only the latter and the treatment is not as comprehensive as Edmister's.

Edmister, W. C. HYDROCARBON ABSORPTION AND FRACTIONATION PROCESS DESIGN METHODS. *Petroleum Engr.* 19, 76, 79, 80, 82, 84 (1948) *February.*

Basic information on the McCabe-Thiele, Lewis and Smoker procedures for the solution of problems on continuous fractionation of two component systems is given.

J. D. Parent

Edmister, W. C. HYDROCARBON ABSORPTION AND FRACTIONATION PROCESS DESIGN METHODS. *Petroleum Engr.* 19, 57-61 (1948) *March.*

The solution of fractional distillation problems for binary mixtures using y-x and Ponchon-Merkel charts are considered. The case of variable relative volatility is discussed.

J. D. Parent

Multiple Fractionation Calculations

Bailey, R. V. and Coates, J. SIMPLIFIED MULTI - COMPONENT FRACTIONATION CALCULATIONS. PART I. *Petroleum Refiner* 27, 98-102 (1948) *January;* PART II. *ibid.* 113-115 (1948) *February;* PART III. *ibid.* 96-102 (1948) *March.*

This is a series of three articles in which several methods are presented for the calculation of minimum reflux ratios and number of trays required in multi-component fractionation. These methods are presented as an improvement over certain previously published methods, in that the time required for calculations has been shortened and, in many cases, the accuracy has been improved.

H. Dirksen

Thermodynamics

Edmister, W. C. APPLICATIONS OF THERMODYNAMICS TO HYDROCARBON PROCESSING. PART VIII. VAPOR PRESSURES AND EQUATIONS OF STATE. *Petroleum Refiner* 27, 100-107 (1948) *February.*

In the present chapter, vapor pressure equations and equations of state suitable for hydrocarbon calculations are discussed. Vapor pressure data may be correlated graphically using the methods of Cox or Coates-Brown. Variations of the Clapeyron equation are also discussed. The equations of state are presented in two series, those explicit in pressure and those explicit in volume. Generalized P-V-T correlations for hydrocarbons usually are based on the use of "reduced" pressures, volumes and temperatures.

S. Katz

Edmister, W. C. APPLICATIONS OF THERMODYNAMICS TO HYDROCARBON PROCESSING. PART IX. *Petroleum Refiner* 27, 83-89 (1948) *March.*

Part IX of this series continues the discussion of the application of equations of state to hydrocarbon studies which was begun in Part VIII. The relative merits of graphical and analytical presentations of data are discussed. The reduced equation of state is described, and is considered in relation to gas mixtures. Several variations of the compressibility factor are presented, as well as a discussion of volume residuals. Throughout the paper, the need for good experimental data is indicated.

S. Katz

11. PROCESS EQUIPMENT AND INSTRUMENTATION

Gas Holders

Blatchley, C. G. SIMPLE JET DEVICES PREVENT FREEZING OF SEALING WATER IN GAS HOLDERS. *Am. Gas J.* 168, 28 (1948) *March.*

The prevention of freezing of sealing water in

gas holders is accomplished by the use of efficient and inexpensive steam jet syphon and water jet eductors. Steam condenses in the jet syphon, circulates and heats the sealing water. Warm water under pressure entering water jet eductors accomplishes the same purpose.

E. Strong

Effect of Baffles

Mack, D. E. and Kroll, A. E. EFFECT OF BAFFLES ON AGITATOR POWER CONSUMPTION. *Chem. Eng. Progress* 44, 189-194 (1948) *March.*

The effect on power consumption was determined for various sizes, number and position of baffles, for position of impeller relative to tank height and for liquid depth and tank diameter when employing a flat impeller and water as the agitated liquid. It was noted that at "fully baffled" conditions a maximum power will be drawn by the impeller at any given speed. The "fully baffled" condition is obtained when the velocity of the impeller relative to the liquid represents the true impeller velocity. For this condition a power constant Pg/N^3L^5P (where P denotes the power input to the agitator shaft; g, the gravitational constant; N, paddle rotational speed, rev per unit time; L, paddle length; and P, density of fluid in consistent units) which is independent of the dimensions of the vessel may be used to characterize the impeller. Experimental curves and a description of baffle arrangements for a "fully baffled" condition are included.

C. Von Fredersdorff

Heat Exchangers Design

Schmidt, E. THE DESIGN OF CONTRAFLOW HEAT EXCHANGERS. *Engrs. Digest* 5, 55-60 (1948) *February* from a paper presented to the *Institution of Mechanical Engineers*, January, 1948.

The author has made a mathematical analysis of the interrelationships between stream properties and heat exchanger dimensions and operation. The calculations were made to provide a basis for designing gas heat exchangers in aircraft turbines. With the aid of Reynolds' analogy, formulas are developed for calculating total cross-sectional area, stream velocity, and L/d from allowable energy loss per unit flow, gas temperature change, fluid properties, and available temperature driving force. Inside and outside diameters are selected from considerations of stress, manufacturing, and practical operation. An expression is developed relating inside and outside diameters, viscosities, specific weights, and energy losses for an exchanger of minimum weight and a table of values given. From this table the temperature driving force is obtained, which permits determination of length, cross-section and velocity of flow.

C. L. Tsaros

Instrumentation

Wilson, J. G., Karr, H. M. and Long, M. V. INSTRUMENTATION AS APPLIED TO SPEED CONTROL. *Petroleum Refiner* 27, 120-129 (1948) *March.*

A general discussion of the subject of instrumentation as applied to speed control was presented. Various phases discussed were: (1) the more necessary functions of a speed controller, (2) the commoner types of speed sensing devices, (3) the five general types of speed controllers, and (4) the various representative applications of these controllers.

B. E. Hunt

Internal Insulation

Darling, P. E. INTERNALLY INSULATED PRESSURE VESSELS, PIPING, FOR HIGH

TEMPERATURE SERVICE. *Petroleum Processing* 3, 339-340, 342, 344 (1948) *April.*

The application of internal insulation has made possible the satisfactory and economical construction of vessels and piping for a number of processes where the requirements of large lines and vessels for high temperature service make the use of suitable alloy steels uneconomic. Practical examples are given of the factors involved and the problems met in the use of internal insulation in vessels and piping on a Hydroforming and a Fluid catalytic cracking unit. The examples are credited by the author as representing the combined engineering contributions of many individuals in different companies.

Author's abstract

Metering of Natural Gas

Spink, L. K. ACCURATE WIDE RANGE METERING OF NATURAL GAS WITH THE DIFFERENTIAL TYPE METER. *Am. Gas J.* 168, 23-26 (1948) *March.*

This paper discusses two of the limitations of the differential type of flow meter when used to increase widely varying flows. First is the measurement of rapidly varying flows. Since the rate of flow is proportional to the square root of the differential, rates obtained from average differentials on widely varying flows will be inaccurate. The average square root is not the same as the square root of the average. Damping of the meter response, various methods of reducing the velocity of the amplitude and the use of integrating devices are discussed. The second problem concerns readability of meters on widely varying flows. Readability is increased by the use of uniform flow chart scales, the installation of several meters or recording devices covering different ranges.

E. Strong

Valve Replacement

Stephens, D. K. REPLACING VALVES ON DRIPS AND TAKE-OFFS WITHOUT INTERRUPTING SERVICE. *Gas* 24, 46-47 (1948) *March.*

The Panhandle Eastern Pipe Line Company investigated the possibility of increasing the capacity of their pipe lines by raising the operating pressure. They found that the pipe and main line valves could safely stand an increase in pressure while certain valves on drips and lateral lines could not. After blocking off service to drips and lateral lines only, new high pressure valves were installed downstream to the old ones. In each case both valves were opened; the old valve was then completely inclosed with a welded section of a larger diameter pipe. Before making the final closure, the packing of the old valve was loosened allowing an equalization of pressure inside and outside the valve protecting it from any pressure higher than that for which it was designed. Seventy inch installations were made at a cost of about $150 each. If the service on the transmission had been interrupted to make these installations the cost would have been around $1,525 for each.

E. Strong

Welded Process Vessels

How, H. SHORT-CUT ESTIMATION WELDED PROCESS VESSELS. *Chem. Eng.* 55, 122-126 (1948) *January.*

A series of charts based on average experience are presented to permit a fast, rough estimate of the cost of welded process vessels. The cost of gas cutting, plate rolling, edge preparation, welding labor, and welding rod and flux is given, based on weld type and plate thickness. Means of estimating shop overhead or burden are also discussed.

W. K. Zahray

12. MATERIALS OF CONSTRUCTION

Corrosion in Meters

Jones, S. and Speers, J. A. INVESTIGATION ON CORROSIVE MATTER IN METERS. *Gas World (British)* 128, 520-521 (1948) *April* 3.

Presence of ammonia as found in gas mains corroded bare steel plate slightly and had no effect on tin plated steel, however in the presence of H_2S, NH_3 acted as a corrosion inhibitor for tin plated steel, while H_2S alone corroded it severely.

S. Mori

Corrosion in the Petroleum Industry

Morton, B. B. METALLURGICAL METHODS FOR COMBATING CORROSION AND ABRASION IN THE PETROLEUM INDUSTRY. *J. Inst. Petroleum* 34, 1-68 (1948) *January.*

To counteract corrosion and abrasion in the petroleum industry, many alloys are used. These are grouped in this article as follows: production, transportation, and refining. Of particular interest in refining are alloys for use with different chemical reagents as well as alloys suitable from the standpoint of creep strength and corrosion resistance at higher temperatures. These data are available to 1800°F.

S. Mori

High Pressure Blowouts

Fagin, K. M. HOW HIGH PRESSURE GAS BLOWOUTS IN A TEXAS FIELD WERE BROUGHT UNDER CONTROL. *Petroleum Engr.* 19, 94, 96, 98, 100, 102 (1948) *February.*

The author describes a series of tests on a 0.4% carbon open hearth steel of 52,000 psi minimum yield point and 75,000 psi minimum tensile strength. Much of the manuscript is devoted to welding technique.

J. D. Parent

Seamless Line Pipe

Wilder, A. B. and Tyson, J. D. METALLURGICAL PROPERTIES OF HIGH YIELD STRENGTH SEAMLESS LINE PIPE. *Petroleum Engr.* 19, 138, 141, 144, 146, 148, 150, 152 (1948) *February.*

This article is concerned with methods used in controlling certain blowouts in some wells of Magnolia Petroleum Company.

J. D. Parent

13. NEW BOOKS

Calculations of Analytical Chemistry

Hamilton, L. F. and Simpson, S. G. CALCULATIONS OF ANALYTICAL CHEMISTRY. 4th Ed. New York, McGraw-Hill, 1947.

This book is divided into seven parts dealing, in text book style, with the methods of calculation involved in qualitative and quantitative analysis. The first part on general analysis treats mathematical operations, chemical equations, formulas, concentration of solutions,

equilibrium constants, and oxidation potentials. The second part, emphasizing gravimetric analysis, discusses the chemical balance, gravimetric analysis, electrolytic methods, and reported percentages. Part three, on volumetric analysis, is concerned with the calibration of measuring instruments, neutralization methods, oxidation and reduction methods, and precipitation methods. Part four, on electrometric methods, describes the calculations of potentiometric titrations, conductometric titrations, and amperometric titrations. Part five explains the calculations of gas analysis, and part six serves as a reference on calculations of common analytical determinations. Part seven takes up problems on specific groups and determinations in qualitative and quantitative analysis. Numerous sample problems are included for each phase of subject matter covered.

H. Hakewill

Nomogram

Allcock, H. J. and Jones, J. R. THE NOMOGRAM. London, Sir Isaac Pitman & Sons, Ltd., 1946.

The authors attempt to combine a discussion of the general theory with functional directions for the construction and use of all classes of computation charts having scientific or industrial applications. In every case stress has been laid on the details of construction, and examples are given illustrating the various methods employed.

H. Dirksen

Theory of Equations

Griffiths, L. W. INTRODUCTION TO THE THEORY OF EQUATIONS. New York, John Wiley & Sons, Inc., 1947.

In this volume, the subject matter of what normally constitutes a first college course in the theory of equations is covered. Topics covered include binomial, cubic and quartic equations, roots of polynomial equations, determinants, complex numbers and symmetric functions. Horner's method, which gives real roots only, is used in the computation of roots of polynomials. The treatment of determinants is unusually thorough.

S. Katz

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